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Evaluation of stevia as an artificial sweetener on physiochemical and sensory properties of diet phalsa squash

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Diet soft drinks are becoming popular due to many health advantages over conventional soft drinks like obesity, diabetics and tooth decay caused by cane sugar. Among artificial sweeteners sucralose and stevia have gaining popularity due to certain health benefits over traditional sweeteners like aspartame and acesulpham potassium etc. in the current study diet phalsa squash was produced by replacing common sugar with sucralose and stevia. A total of three samples were prepared i.e. T1 sucralose, T2 stevia and T3 sucralose and stevia. Products were filled in pet bottles and stored at room temperature for 90 days. Physical and chemical characteristics like Brix, Acidity, pH ash Fiber, Viscosity, Taste and Aroma were analysed as per methods described. As per results of analysis, brix and pH were increased with increase in storage time. Highest increase was observed in T1 from 1.1 to 1.7 and maximum pH was increased in T1 from 3.90 to 4.62.while viscosity and fiber were decreased with the increase in storage period. Highest decrease in viscosity was found in T3 from 83 to 53 centipoises while negligible decrease was found in fiber. Protein and ash contents were found not detected in all samples except control (T0). The chemical characteristics of T1 and T2 and T3were almost same while the sensory characteristics of T2 were found better as compared to the sensory evaluation of T1 and T3. Diet phalsa with sucralose(T1) and phalsa squash containing both sucralose and stevia (T3) could not qualify in sensory competition due to an unacceptable taste and aroma as compared to T2. All the products prepared were compared to regular phalsa squash containing table sugar as control (T0). It is hypothesized that stevia will be more acceptable than sucralose as a sweetener in diet phalsa squash in terms of sensory properties."
Stevia is becoming more popular among other intense sweeteners due to the unique properties. So, the use of stevia in soft drinks may be marked as safe alternative natural artificial sweeteners in commercial production because these are extracted from plants.
Keywords: Sugar substitute, low calories, bulk sweeteners, nutritional benefits, health risks.

INTRODUCTION

The trend of consuming artificial sweeteners is increasing day by day due to obesity, diabetics and tooth decay caused by cane sugar. Most popular diet obese, diabetic and conscious patients prefer sugar free or less caloric products for controlling obesity and glucose level of blood. Intense sweeteners are many times sweeter than sugar which means they can be used in much smaller amounts. They are classed as food additives and added to foods to replace sugar to provide low or lower energy/kilojoule foods or foods that are reduced in sugar or sugar-free. Some scientist and health care professional warn that artificial sweetener may cause health problems like mutogenecity and hypersensitivity. So, more research is needed to approve the usage of artificial sweeteners for a long time in our regular life. However, long term use of artificial sweeteners should be on the advice of consultants. Although, natural sweetness like Stevia is considered safer because these are extracted from plants. Stevia has been marked as an alternative natural artificial sweetener. Currently stevia being used in many countries like USA, Japan, China and Canada. The French govt. was firstly approved stevia use, safe for body as a natural sweetener, in the European Union. Genotoxic study of stevia side showed no evidence of genotoxicity. JOINT expert committee on food additives allows the 5ml/kg of body, daily use of stevia. In the current study intense sweeteners like Steviaand sucralose were used in the formulation of diet phalsasquash as sugar

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replacer. Main objective was to compare the sensory acceptability of stevia and sucralose as sweeteners in phalsa squash and to determine the optimal concentration of sweeteners, to assess the stability of the sweetened beverages during storage.

MATERIALS AND METHODS

Present research was conducted to find out the best intense sweetener for application in phalsa squash. This experiment was carried out in food and biotechnology research center of Pakistan council of scientific and industrial research Lahore.

Material: Phalsa fruit for squash was purchased from local fruit market at Multan road Lahore. Sugar, stevia, sucralose, citric acid, sodium benzoates were procured from the Karachi Essence House new anarkali Lahore. While analytical reagents like NAOH, H_2SO_4 were purchased from new chemicals Lahore.

Material preparation: Fresh Phalsa was washed, and juice was extracted by hydraulic filter press. The extracted juice was divided in three equal portions for development of three formulations i.e. T1 with sucralose, T2 with stevia and T3 with sucralose & stevia. The extracted juice was filtered to remove any stones and foreign matter. Sweetener, citric acid, stabilizers, permitted food color and flavor were added to standardize the formulations. Squashes were pasteurized at 85^0C for just 15 second to kill the pathogenic organisms. Quality control tests like aroma, taste, brix, viscosity and acidity were conducted before filling. Squashes were filled in cleaned plastic bottles for storage study. Regular phalsa squash of well known brand was considered as control (T0). After standardization, phalsa juice was pasteurized and filled in pre cleaned pet bottles. The bottles were stored at room temperature for 90 days for physical, chemical and sensory evaluation. Chemical tests like Brix, acidity, pH viscosity, fiber, ash contents were analyzed as per methods described in AOAC.(2016) while sensory characteristics were determined by a panel of trained judges as per method described by Sallam,(2016)

RESULTS

Acidity values decrease with increase in the storage duration. Phalsa squash with sugar (T0) it ranged from 0.61% to 0.54% and T1 acidity range from 0.63% to 0.52%, T2 from 0.62%to 0.50% and for T3 ranged from 0.62%to 0.53.

pH content was also recorded by using digital pH meter. During storage an increase in pH was recorded from 3.65 to 4.12 in T0, 3.90 to 4.62 for T1, 3.89 to 4.43 for T2 and for T3it increased from 3.81 to 4.46.

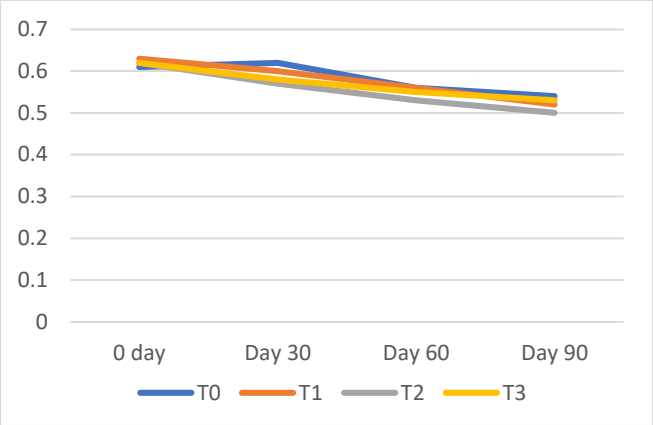

Figure 1. Acidity of phalsa squash

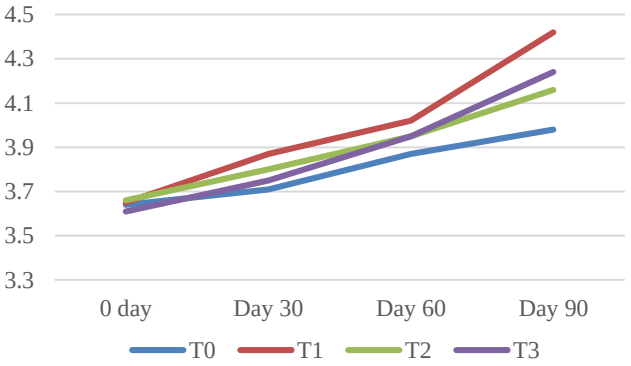

Figure 2. pH of phalsa squash

Viscosities of the samples differ slightly and decreased during the storage. Viscosity of control (T0) ranged from 95 to 68 centipoises, Phalsa squash with sucralose (T1) from 75 to 58 centipoises, Phalsa squash with stevia (T2) from 80 to 69 centipoises and for T3 ,it ranged from 83 to 53 centipoises.

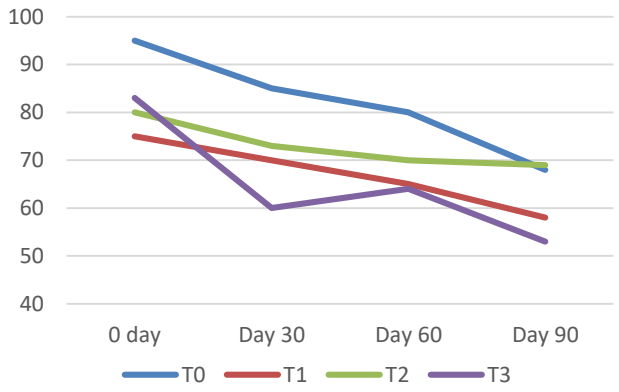

Figure 3. Viscosity of phaslsa squash

Brix of squash prepared also increased with the storage period. In Control it was observed from 14.7to 15.2, in T1

from 1.1 to 1.7, T2 from1.5 to 1.9and for T3 it ranged from 1.7to1.9.

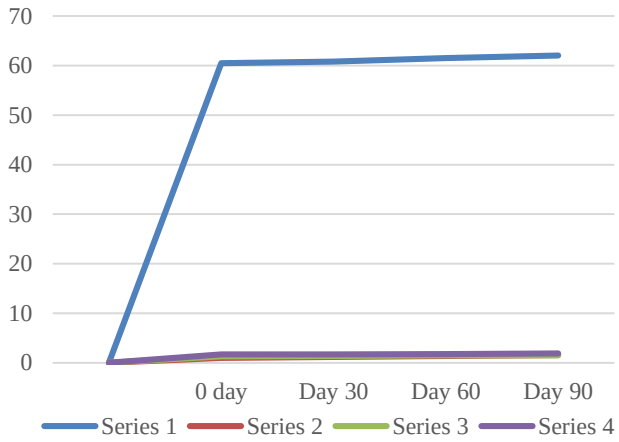

Figure 4. Brix of phalsa squash

During storage, a decrease in fiber content was observed with storage period. In control it decreased from 0.010 g to 0.009 g, 0.012 g to 0.011g for T1, 0.011g to 0.010 g for T2 and for T3 fiber contents decreased from 0.012 g to 0.010 g with the storage period.

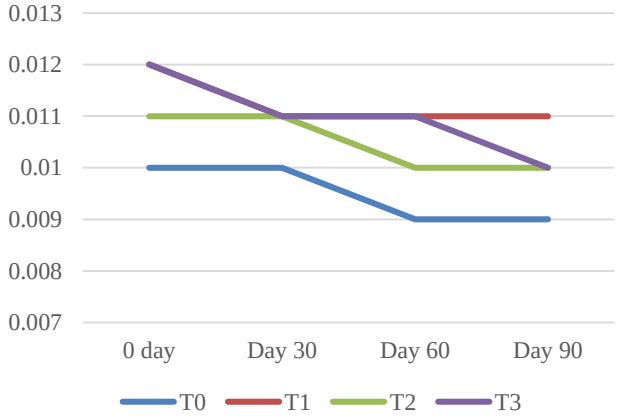

Figure 5. Fiber content of phalsa squash

During storage after 30 days interval an increase in theashvalueswererecordedfrom0.003g to 0.0035g for T0 and in T1, T2 and T3 samples ash contents was not detected. During storage, in control sample (T0) negligible increase is recorded from 0.003g to 0.0035 g. Protein contents were zero in all To.T1.T2 and T3 samples.

Sensory evaluation was also different from one another. T1 and T2 both were not liked due to unacceptable taste while T3 performed best in sensory performance. There was no after taste feeling in T2 as appeared in T1 and T3.

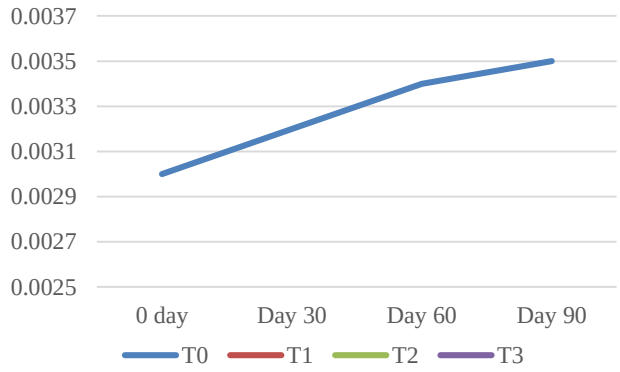

Figure 6. Ash in phalsa squash

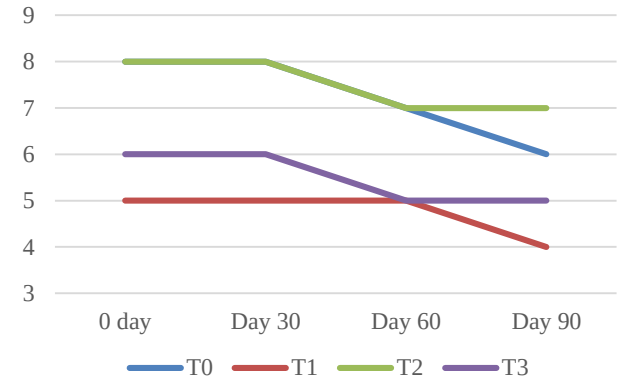

Figure 7. Taste of phalsa squash

Aroma of the samples differ slightly and decreases during the storage. The same trend was observed in the case of taste.

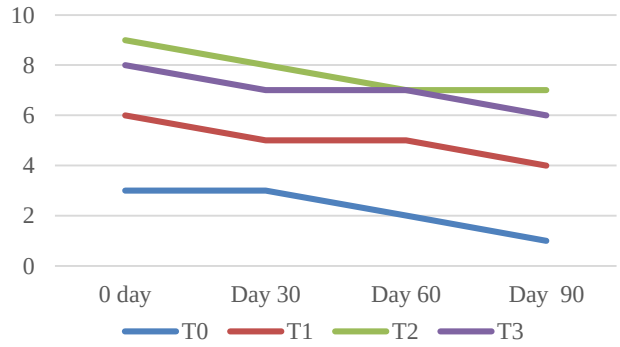

Figure 8. Aroma of phalsa squash

DISCUSSION

Acidity values decrease with increase in the storage duration. Phalsa squash with sugar (T0) it ranged from 0.61% to 0.54% and T1 acidity range from 0.63% to 0.52%, T2 from 0.62% to 0.50% and for T3 ranged from 0.62% to 0.53. The same decreasing trend was observed by N. Gupta, 2020. It might be

due to the conversion of acids into salts and sugars by enzymes particularly invertase (Sogi and Singh, 2001).

Viscosities of the samples differ slightly and decreased during the storage. Viscosity of control (T0) ranged from 95 to 68 centipoises, Phalsa squash with sucralose (T1) from75 to 58 centipoises, Phalsa squash with stevia (T2) from 80 to 69 centipoises and for T3 it ranged from 83 to 53 centipoises. Phalsa squash may contain solids particles that can settle over time. These solids can contribute to the initial viscosity of the squash. As the solid settles, the liquid portion becomes less viscous. Phalsa squash may undergo chemical reactions over time, resulting in degradation or alteration of certain components. These reactions can lead to change in viscosity.

pH content was also recorded by using digital pH meter. During storage an increase in pH was recorded from 3.65 to 4.12 in T0, 3.90 to 4.62 for T1, 3.89 to 4.43 for T2 and for T3it increased from 3.81 to 4.46. This decrease in acidity and increase in pH might also be due to ascorbic acid degradation, hydrolysis of pectin or degradation of polysaccharides and oxidation of reducing sugar (Pavlova V. *et al*., 2011)

Brix of squash prepared also increased with the storage period. The increase in brix value may be due to conversion of sucrose in glucose and fructose. In Control it was observed from 14.7to 15.2, in T1 from 1.1 to 1.7, T2 from1.5 to 1.9and for T3 it ranged from 1.7 to 1.9.

During storage, a decrease in fiber content was observed with storage period. In control it decreased from 0.010 g to 0.009 g, 0.012 g to 0.011g for T1, 0.011g to 0.010 g for T2and for T3 fiber contents decreased from 0.012 g to 0.010 g with the storage period. Fiber content decreases during storage because of the solubility of fiber content due to the presence of acid with the passage of time.

During storage after 30 days interval an increase in the ash values were recorded from 0.003g to 0.0035g for T0 and in T1, T2 and T3 samples ash contents was not detected. Absent in ash contents may be due to absence of table sugar which contributes in ash formation. Ash content of food stuff represents inorganic residue remaining after destruction of organic matter (Vidhya R. 2011). During storage, in sample control a negligibleincrease is recorded from 0.003g to 0.0035 g. Storage Time did not affect the ash content of the produced squash (C. 2012). Protein contents were zero in all To, T1, T2 and T3 samples. Sensory evaluation was also different from one another. Both T1 and T2 were not liked due to unacceptable taste while T3 performed best in sensory performance. There was no after taste feeling in T3 as appeared in T1 and T3. The difference in taste may be due to the characteristics taste of sucralose. However, the taste of Phalsa squash decreased over time, it changes in flavor, texture and overall quality as it ages. This change in taste can occur due to various factors including exposure to air, light and enzymatic reactions that alter the conformation of fruit.

The aroma of the samples differs slightly and decreases during the storage. Exposure to heat, light and temperature, can accelerate the breakdown of volatile compounds and promote the degradation of aroma. Phalsa squash should ideally be stored in cool, dark places to minimize the loss of aroma, that's why the aroma of phalsa squash decreases with storage time and same trend was observed in the case of taste.

***Conclusion*:** It is concluded from the research work that Stevia is the best sweetener for diet soft drinks like diet squash. Ascomparedto others intense sweeteners Stevia performed the best in physicochemical and sensory evaluation. Phalsa squash containing sucralose and was not accepted due to after taste. Stevia may be recommended in commercial recipes soft drinks as safer substitute of table sugar due to less health risks. However long-termuse of stevia may be advised by medical consultants.

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